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Assessing the Added Value of Information Systems supporting Facilities Management Business Processes

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ABSTRACT

Purpose: To present a method for assessing the added value of Information Systems (IS), which are implemented to support the business processes in Facilities Management (FM).

Theory: The method is based on a supply chain management model of FM, general value dimensions such as efficiency and effectiveness and the concepts of Value Adding Management (VAM) and Functional Affordances of IS.

Design/methodology/approach: From case studies of IS implementation processes in FM in different countries, a general picture of the expressed added value of IS in FM was established. Based on this insight a method for assessing the added value of IS in FM was developed. The proposed method is applied to one of the cases.

Findings: The paper analyses how a specific IS supports the management of a specific operational process – cleaning in an airport. The assessment shows that the IS definitely adds value to the cleaning process and because the resulting increase in user experience of the cleaning level is aligned with the strategy of the corporation, the IS also adds value to the primary process of the organisation. The analysis reveals that a well organised management setup is required to gain value from IS. It also illustrates that implementing IS includes both organisational and technological changes and demonstrates that the proposed assessment method is applicable to practice.

Originality/value: This is the first paper using a supply chain management model of FM, general value dimensions, VAM and Functional Affordances to access the added value of IS in FM.

Keywords: Information Systems, Added Value, Facilities Management, Business Processes, Functional Affordances

1 INTRODUCTION

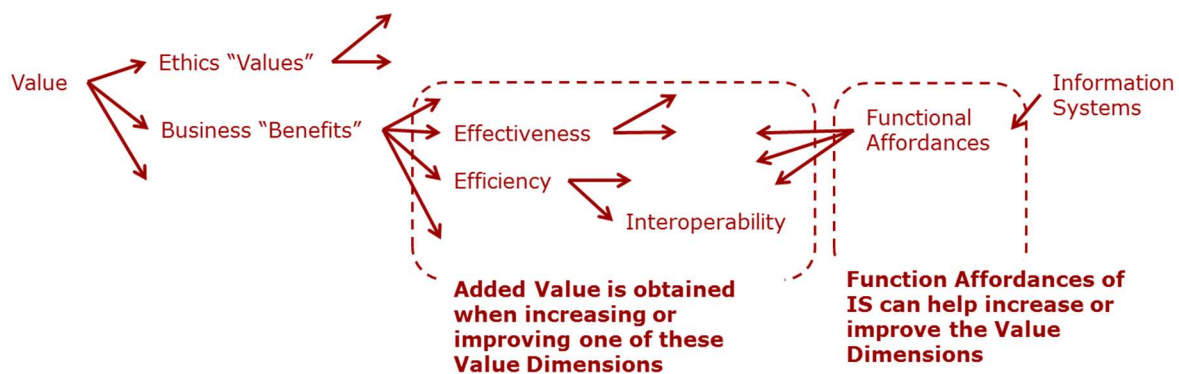
Assessing the added value from the effort of implementing Information Systems (IS) supporting Facilities Management (FM) processes is associated with major challenges. It is often unclear what added value is expected and what part of the supply chain of FM deliveries that benefits from the IS. One reason for this might be that the concept of value is not well defined and as a consequence can be difficult to use as a sole parameter. Furthermore it is often not understood very well how the parts in the supply chain of FM deliveries are interconnected. This paper therefore proposes a general method for assessing the added value of IS in FM. The underlying research question of this paper is: How can the added value of IS supporting FM business processes be assessed?

The structure of the paper is as follows: In section 2 different value concepts and dimensions relevant for this paper are presented as well as the concept of Value Adding Management (VAM) and the Supply Chain Management Model of FM. Section 3 gives an overview of the added value from IS as expressed by respondents in five IS implementation cases. It shows that only parts of the value picture are explicitly expressed, and that there is a need for a general model for assessing the value of IS. The methodology of the research leading to the development of the method is explained in section 4. The case study used to exemplify the proposed model is presented in section 5 and in section 6 the assessment method is discussed and conclusions are drawn.

2 VALUE CONCEPTS

There is no commonly accepted definition of value (Thyssen, 2011, p. 53). The plural version "values" is often related to ethics or moral issues. In this paper value is understood as benefits to the business. There are of course many types of benefits. To achieve value, or to add value, often some sort of effort or sacrifice is required. Examples of benefits from the effort of implementing an IS can be increased efficiency and improved effectiveness of the business processes, and improved Interoperability. But implementing an IS in an organisation, can of course also have many other types of benefits, e.g. improved working conditions. Each type of benefit can add value to the business. The left side of the tree structure in Figure i illustrates the explained relations between these value concepts.

Figure i Value and IS concepts

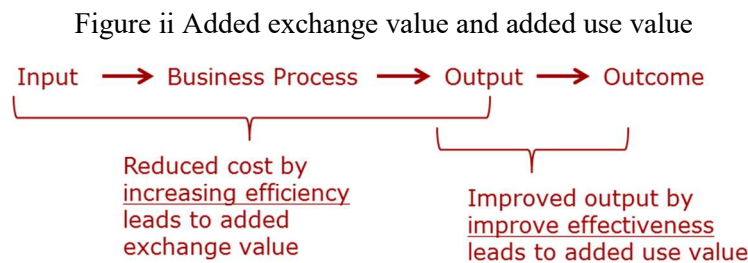


The right side of Figure i shows that IS can offer functional affordances, some of which can improve effectiveness, increase efficiency or improve interoperability. The concepts of functional affordances and interoperability are explained more detailed below. When assessing added value, one should of course ask whether e.g. the increased efficiency and the improved effectiveness is worth the effort.

In the FM standard EN 15221-1, FM is defined as "Integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities" (CEN, 2008). Jensen et al. (2012) combine this definition of FM with an extensive review on value terminology in the FM literature and conclude that creating **Value** to the core business, translates for FM into – as a minimum – delivering and maintaining services that – at a competitive level – support the effectiveness of the primary activities. To create **Added Value** it is necessary for FM also to develop the services in such a way that they improve the effectiveness of the primary activities (Jensen, 2012, p. 279). In addition they conclude that FM also can contribute considerably to the efficiency of the primary processes and to the efficiency

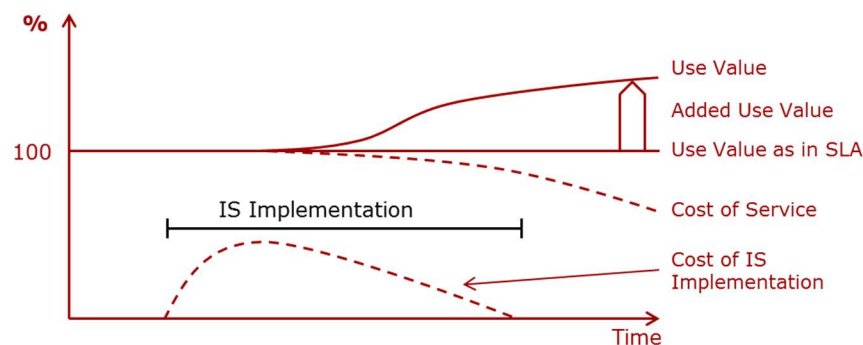
and effectiveness of the supporting processes as well. This paper focuses on added value, such as increased efficiency and improved effectiveness of FM processes, which mainly are supporting processes, from implementing and using IS in FM.

Different types of value can be found in the literature. Exchange value and use value both relate to change over time. In terms of exchange value the focus is on cost and the relationship between output and input in a business process. The added value can be defined as the value of the product reduced by the value of the resources used during the process. Thus reducing cost by increasing efficiency leads to exchange value (Jensen et al., 2012, p. 59). Use value only relates to the output, and possibly the outcome of a process. Improved output by improving effectiveness leads to added use value. See Figure ii.



Based on Jensen et al. (2012, fig. 4.1) an ideal relative development over time in cost and use value of an FM service, initiated as a result of an IS implementation process in an organisation, is illustrated in Figure iii.

Figure iii Ideal relative development over time in use value, cost of service and cost of IS implementation
(Based on Jensen et al., 2012)



The base line for use value can be specified in a Service Level Agreement (SLA). The use value of the service can for instance be measured by Key Performance Indicators (KPI) with a minimum level of customer satisfaction. An increase in use value will occur if the customer satisfaction over time gets higher than the minimum level of customer satisfaction. This means that added use value is created. A cost reduction of the service occurs, if the cost of the service goes down below the base line without lowering the customer satisfaction below the minimum level. The curve in the bottom of Figure iii shaped as a hump represents the investment in the IS implementation. It can be seen as the effort of IS implementation.

Two central value related concepts: Efficiency and Effectiveness

The two concepts efficiency and effectiveness are central to the IS assessment method presented in this paper. Most organisations strive to be more efficient and more effective, but there is no

common definition of the two concepts. Table 1 gives an overview of some of the definitions of the two concepts which are explained in the following.

Efficiency and effectiveness both describe the performance of business processes (Chaffey, 2014). The most simple definition of efficiency is “doing the thing right”, and the most simple definition of effectiveness is “doing the right thing”.

According to Schneider and Leslie (2015) increasing efficiency means allowing an organisation to do the same amount of work with fewer resources and examples of this can be automation of manual processes or organisational restructuring/outsourcing. Improving effectiveness means allowing organisations to generate higher revenue, independently of resources required. (Schneider and Leslie, 2015).

Table 1 Definitions of Efficiency and Effectiveness

	Efficiency	Effectiveness	Reference
Definitions	Doing the thing right	Doing the right thing	(Chaffey, 2014)
Increase / Improve	Do the same amount of work with fewer resources	Generate higher revenue, independently of resources required	(Schneider and Leslie, 2015)
	Reduced cost by increasing efficiency leads to added exchange value	Improved output by increasing effectiveness leads to added use value	(Jensen et al., 2012)
Management	Industrial Management	Preparedness Management	(Jensen and Katchamart, 2012)

Interoperability

Interoperability is the ability to exchange data between applications, which smoothes workflows and sometimes facilitates their automation (Eastman et al., 2011). Improved Interoperability may therefore add value to business processes. Interoperability can provide information not only used for FM processes, but also used by the rest of the organisation (Keller, 2013). Interoperability can shorten the time it takes to retrieve information and thereby increase efficiency of business processes. In Figure i Interoperability is therefore shown as a sub value dimension under efficiency.

Functional Affordances

Affordance can be understood as the multiple uses for which artefacts may be employed (Gibson, 1986). According to Gibson we do not perceive the qualities of objects but their affordances. The concept has been employed in sociological studies of technology and recently in the IS literature (Schellhammer, 2011). “Although the material properties of a technology are common to each person who encounters them, the affordances of that artefact are not. Affordances are unique to the particular ways in which an actor perceives materiality.” (Leonardi, 2011, p. 153). Functional affordances are potential uses of IS based on users’ interpretation of their material properties dependent on the use context (Markus and Silver, 2008). Some functional affordances of IS may add value, e.g. in the form of increased efficiency or improved effectiveness of a business process. See the right side of Figure i. Functional Affordances is a core concept for understanding the added value of IS. It is the people involved who interpret potential uses (affordances) of an IS and whether these are useful in the given context.

VAM and the Supply Chain Management Model of FM

The concept of Value Adding Management (VAM) in FM as developed by Jensen and Katchamart (2012) focuses on the relationships between FM and core business and is concerned with how FM can add value to the core business and to relevant stakeholders. VAM draws on the management model of FM from the FM taxonomy standard CEN (2011), which is shown as a basis for Figure vi in the case analysis. In the model a distinction is made between the demand side and a supply side, and relations between the two sides are based on FM agreements. Interaction between demand and supply takes place on three levels: Strategic, tactical and operational, which are related to client, customer and end user, respectively. Primary processes and activities of the organisation take place on the left side. Support processes and facility services from internal and external providers take place on the right side. Demands can be based on Service Level Agreements (SLA) and delivery can be measured by Key Performance Indicators (KPI).

Compared to other forms of management, VAM can be distinguished in relation to efficiency and effectiveness, which is shown as a basis for Figure vii in the case analysis. VAM is placed in the upper right corner where both efficiency and effectiveness have high priority. A lack on management focus may result in low efficiency and effectiveness, which is shown as Laissez Faire Management. A primary management focus on optimizing efficiency is shown as Industrial Management, which could e.g. be LEAN or AGILE management. A primary management focus on effectiveness is shown as Preparedness Management, which as an extreme example could be found in a fire brigade, where an organisation is constantly prepared for an occurrence of an undesired event (Jensen and Katchamart, 2012).

3 EXPRESSED ADDED VALUE IN 5 CASE STUDIES

As part of a qualitative study of IS implementation cases in FM departments employees and managers, involved in the IS implementation process, were asked about the value added from the IS being used (existing) and from the IS being implemented (future). An overview of the responses given in five of the cases is shown in Table 2. Different areas such as information retrieval, cost, political positioning in the organisation, business processes, user experience, alignment with business strategies are improved and thereby adds value, according to the respondents. Improvements in each of these areas increase efficiency or improve effectiveness. In each case there seems to be a general lack of clarity and focus on the overall added value of the IS being implemented. Only parts of the “value picture” are expressed by the respondents, and it is often unclear what part of the supply chain of FM deliveries should benefit from the IS. Awareness or knowledge of the value added can be both explicit and implicit. The respondents may know much more about the value added than they express during the interview.

4 METHODOLOGY

As the prior section shows, there is a need for an overall method for assessing the added value of IS in FM. An attempt was made to establish such a method by including existing concepts and models from the different disciplines, which is illustrated in Figure iv. The approach is somewhat deductive; observations are analysed using predefined theoretical perspectives. First value parameters (value dimensions) suitable for describing the value of business processes and IS were found in the existing literature on value, IS and FM. Secondly an overall concept (functional affordances) for describing what IS can offer in relation to the value dimensions were found in the literature. Next a model describing the FM context (FM supply chain model) was found, and finally a model for assessing the value of management based on the value dimensions was included

(VAM). As illustrated in Figure iv these four elements, the Value Dimensions, Functional Affordances, the FM supply chain model and VAM constitutes the basis of the proposed method for assessing the value of IS in FM.

Table 2 Respondents description of value added from the IS being implemented

Case	Type of IS	Citations from interviews describing the added value	Area of improvement	Value Dimensions Increased / Improved	
				Efficiency	Effectiveness
A	Future BIM/GIS based maintenance management system	"It sends an important message that we are involved in this. It will attract others in the organisation to use this system. It is a role we would like to have in our organisation"	Political positioning in the organisation		X
	Existing CAD based space management system	"Improved lease management and improved overview of square meters and real estate portfolio overview"	Business process		X
			Information retrieval	X	
	Existing Helpdesk system	"A user survey shows that 84% of the users experience improvements in maintenance management"	Business Process.		X
			User experience		X
B	All existing and future IS systems	"The overall strategy of the organisation is about simplification , so a lot of these IT solutions are about simplification"	Alignment with business strategy		X
C	Existing BIM and laser scanner based facilities information system	"Trying to come up with a benchmarking system that enables you to see that moving down BIM is cost effective"	Cost	X	
	Existing BIM and laser scanner based facilities information system	"Next time you come along and if you are surveying in the same area we know it is accurate, so you save the cost of surveying"	Information retrieval.	X	
			Cost	X	
D	Future web and fiber based building automation system	"The market sees us at leading in real estate management"	Alignment with business strategy		X
E	Existing CAD/GIS based visualisation management system	"Easy access to information, and very often the graphical accesses is the easiest access"	information retrieval	X	
	Future CAD/GIS based visualisation management system	"It becomes more and more like the system that everyone knows from the internet"	Information retrieval	X	

The method consists of three main steps as illustrated in Figure v. In the first step the IS case is analysed using the FM supply chain model. Activities, roles and levels involved in and interacting with the IS are found. In the second step increase in efficiency and improvement in effectiveness as a result of the IS implementation is assessed. This is done using the definitions of efficiency and effectiveness as illustrated in Figure ii and Figure iii. Furthermore the Functional Affordances of the IS which contributes to increase in efficiency and improvement in effectiveness are identified. Finally in step 3 the degree or level of Value Added Management (VAM) is assessed using the definitions as illustrated in Figure vii.

Figure iv Elements constituting the IS added value assessment method

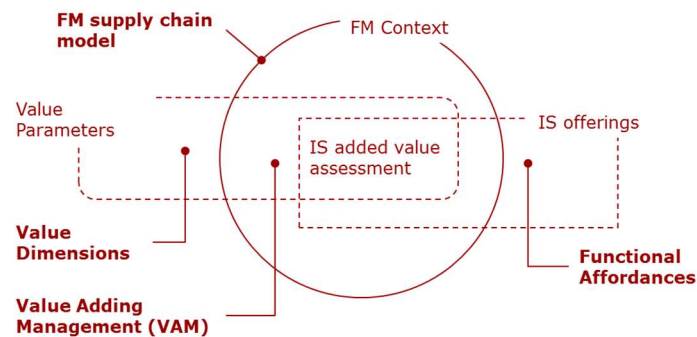
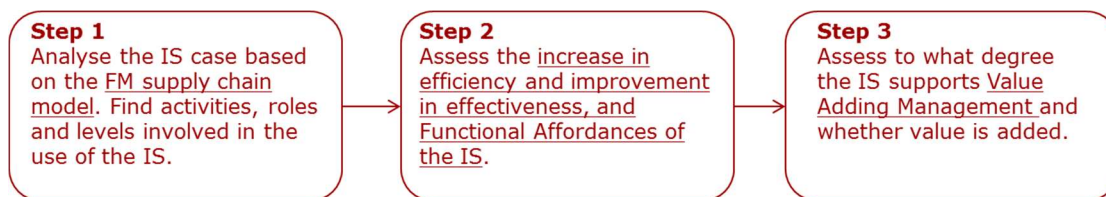


Figure v Three main steps in assessing the value of IS supporting FM



5 CASE STUDY OF IS IMPLEMENTATION

In this section the IS implementation case (case E in Table 2) is introduced and used to exemplify the IS assessment method. The organisation is a large airport in Europe. The specific IS was put into use in 2013 and is intended to support the cleaning processes in the organisation. The IS delivers information about the frequency of use of specific intensely used rooms in the facilities of the airport. Sensors detect when a person enters into one of these rooms, and the system can thereby keep track of how many people have used each room.

Furthermore a use response system has been installed in each of the rooms, enabling users on their way out of a room to report back about their experience of using the room; whether it was Good, OK or Bad. If responding “Bad” the user is asked to report back which specific issues caused the bad experience.

Data from the sensors and from the use response system is presented on a monitor in a simple way to the dispatcher of the external cleaning company. The dispatcher’s role is to coordinate the cleaning process based on the information on the monitor. When a specific number of persons have passed the sensor in a room a field on the dispatchers monitor turns from green to red, and if a specific percentage of users of a room find the experience of using the room bad another field turns from green to red. In each case the dispatcher can then send cleaning personnel to this specific room to see whether cleaning is necessary. If a user reports back about a specific issue that needs to be improved, the dispatcher can then also send personnel to the room to deal with the issue.

Before the IS was implemented and taken into use, cleaning in these rooms was done on a regular basis, e.g. every two hours. Whether there actually was a need for cleaning or whether specific issues needed to be handled, was not part of the cleaning procedures. As a consequence of implementing the IS, cleaning in these rooms is now mainly demand-driven; based on use frequency and user experience responses.

The external company in charge of cleaning these rooms are, according to their contract with the airport organisation, required to use the IS. There are no explicit SLA or KPI sections in the contract between the cleaning company and the airport, but the contract requires the cleaning manager from the cleaning company to send out cleaning personnel when and where it is needed, based on information from the IS, and to respond to specific issues reported by users. The KPI related part of the contract requires the cleaning company to deliver cleaning according to normal standards.

As part of an international benchmarking of airports, users of the airport have the last seven years been asked quarterly about their experience of using the facilities, including their experience with the level of cleaning in these rooms. In general the satisfaction level has increased every year. The introduction of this IS and the change in procedures may have contributed to the increase of the satisfaction level, but also refurbishments and other improvements of the rooms during the same period may have had an impact.

The introduction of this IS and the changes in the work procedures, is aligned with and contributes to the goals and strategies defined by the top management, which includes aiming at being seen by users as the best airport organisation in Europe.

Using the case described above, it is in the following shown how the proposed three step method (see Figure v) can be used to assess the value added by implementing IS supporting FM into an organisation.

Analysing the IS case using the FM supply chain model (Step 1)

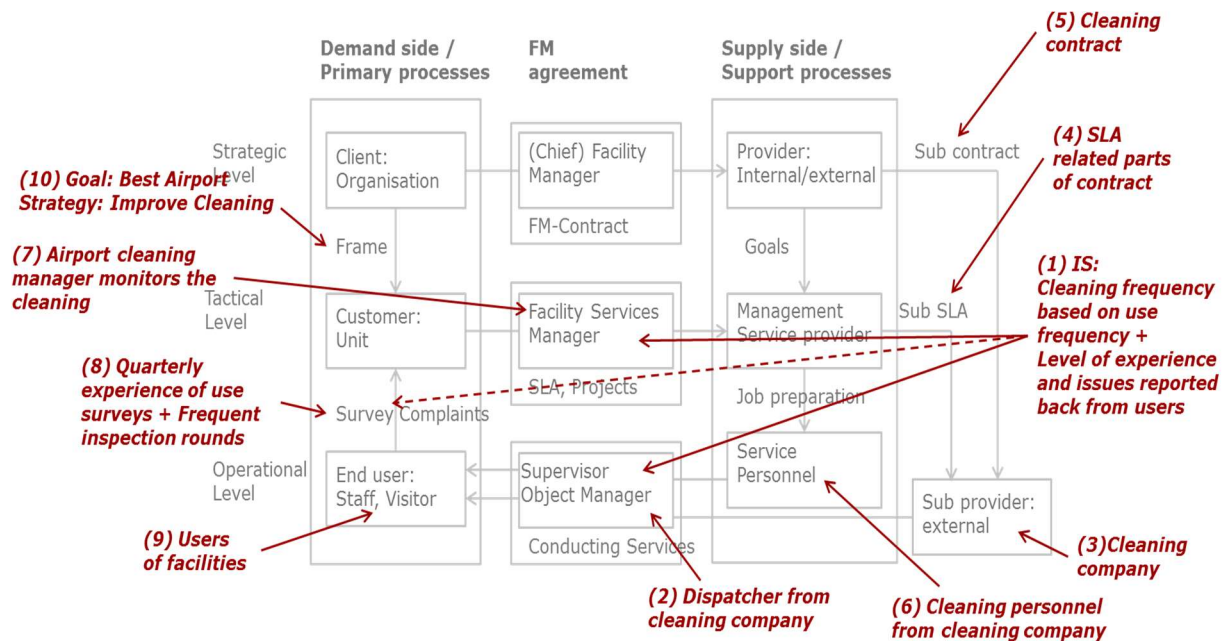
This analysis refers to Figure vi using numbers in brackets. The IS reports frequency of use detected by sensors, and level of experience and issues reported by users (1). On the Supply side the information from the IS is used by the dispatcher (2) from the external cleaning company (3) to manage the cleaning, including the cleaning frequency. As mentioned the SLA (4) related part of the contract (5) between the cleaning company and the airport requires the cleaning manager from the cleaning company to send out cleaning personnel (6) when and where it is needed, based on information from the IS, and to respond to specific issues reported by users. On the demand side the manager responsible for cleaning at the airport (7) monitors the cleaning based on information from the IS, supplemented with occasional inspection rounds in the facilities (8). By use of surveys (8) the user's (9) experience of the facilities is investigated quarterly. As mentioned the surveys, in regard to cleaning, show an increase in the satisfaction level among the users. The use of the IS to support the cleaning business process is aligned with the strategy of improving cleaning and thereby contributes to reach the goal, set by the top management, of being the best airport (10).

Assessing effectiveness, effectiveness and the Functional Affordances of the IS (Step 2)

Cleaning frequency is now based on use frequency and issues reported back from users through the IS. Cleaning is not as earlier done at regular intervals; it is now done when needed.

The quality of the cleaning (the output in Figure ii) has, according to the cleaning manager, improved since the introduction of the IS. Therefore the effectiveness of the cleaning has improved. At the same time the experienced level of cleaning (the outcome in Figure ii) has increased according to the quarterly survey results. The improvement in effectiveness has led to improvements in the output (and outcome), thereby leading to added use value (See Figure ii).

Figure vi Analysing the IS case using the FM supply chain model (Based on CEN, 2011)



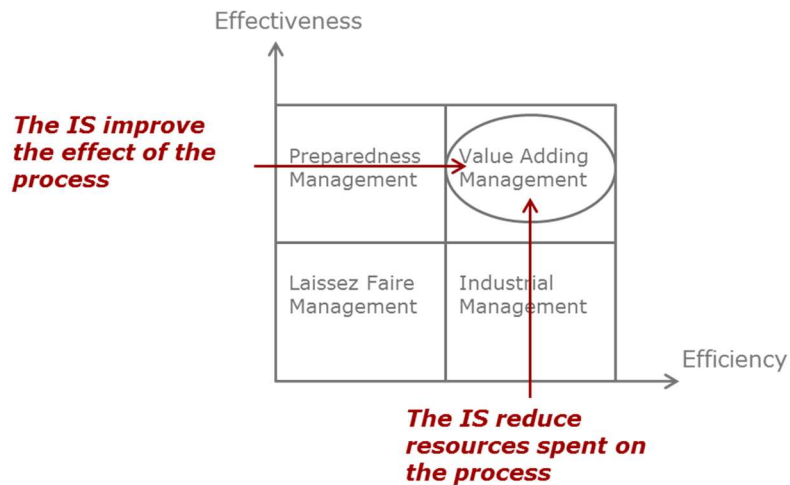
Since the IS was introduced the frequency of cleaning has dropped while the level of cleaning has not dropped. The efficiency of the cleaning has therefore been improved. The airport pays the cleaning company the same for the cleaning, compared to before the IS was introduced. The cleaning company may have reduced their cost as a consequence of increase in efficiency and thereby achieve an added exchange value, but this is not the case for the airport (the client).

A functional affordance of the IS which have increased efficiency is the delivery of real time user frequency information on the monitor. This functional affordance has made it possible for the dispatcher to send out cleaning personnel when a certain number of persons have used a room. The functional affordance of the IS which has improved effectiveness is the delivery of user response information on experience of use and on specific issues. This functional affordance has made it possible for the dispatcher to send out cleaning personnel when specific issues must be dealt with. The fact that the cleaning manager hired by the airport uses the IS to monitor the cleaning process, can be seen as a functional affordance which has improved interoperability; the IS facilitates sharing of data about the cleaning process.

Assessing how the IS supports VAM and whether value is added (Step 3)

The IS supports effectiveness. It delivers information so the cleaning manager better can initiate the right cleaning, thereby improving the effect of the cleaning (added use value). The IS also supports efficiency. The cleaning manager can better initiate cleaning when it is needed, and thereby reduce the resources spent on cleaning (added exchange value). Supporting both efficiency and effectiveness in the management of the process, the IS therefore supports Value Adding Management. See Figure vii.

Figure vii The IS from the case supports both Efficiency and Effectiveness in the management of the process. Therefore the IS supports VAM. (Based on Jensen and Katchamart, 2012)



6 DISCUSSION AND CONCLUSION

Based on the FM supply chain model (CEN, 2011), this paper analyses how a specific IS supports the management of a specific operational process (cleaning). Based on this analysis it is assessed to what degree the IS supports increase in efficiency and improvement of effectiveness. Furthermore the potential Functional Affordances of the IS which are used to achieve these improvements are defined. Finally it is assessed whether the IS supports Value Adding Management (VAM) of the process.

This analysis cannot stand alone. It does not include an assessment of the quality of the management, the work process or the IS. This analysis only helps clarify whether the basic managerial and technological elements needed to achieve VAM are present.

VAM as described by Jensen and Katchamart (2012) includes the two classical business process related dimensions effectiveness and efficiency. When including the IS perspective, interoperability as a third dimension could be included. IS can support interoperability as an element in the management of a process. Interoperability can, e.g. reduce time spent to search for information and can therefore be seen as a dimension increasing efficiency.

Because of the way the cleaning process is organised the potential of the functional affordances of the IS can be exploited. The IS contributes to added value because the dispatcher actually use the information offered by the IS, and because the cleaning work process is organised so that this information can be used. The functional affordances of the IS were seen as useful in this specific context in the strive for VAM. In future cleaning contracts the airport could obtain a share in the potential cost reduction gained by implementing the IS. This could be done by redefining the SLA in the contract.

This paper illustrates that a well organised management setup is required to gain value from IS. It is also illustrated that implementing IS includes both organisational and technological changes. The system keeps track of the state of the cleaning and can be used by the demand side to monitor the quality of the delivery of cleaning.

The system described in this paper is being further developed. For inspections rounds a tablet based inspection report system is being developed, including testing different types of tablets for the purpose. Furthermore it has been considered to equip the cleaning personnel with tablets, so that information from the IS can be sent directly to the cleaning personnel and thereby obviate the dispatcher role.

The use of the IS as described definitely adds value to the secondary process cleaning. Because of the increase of the user experience of the cleaning level, which is aligned with the strategy of improving cleaning in order to become the best airport, the use of the IS also adds value to a primary process of the organisation.

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